

CLAIMS

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[1] An ultraviolet irradiation apparatus for photochemical reactions, which is adapted to irradiate a photo-reactive solution, which undergoes a photochemical reaction by irradiation of ultraviolet radiation, with the ultraviolet radiation, characterized in that the photo-reactive solution is irradiated with ultraviolet rays having a specific wavelength through a quartz rod.

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[2] The ultraviolet irradiation apparatus according to Claim 1, which comprises a condensing and reflecting mirror for condensing and reflecting the ultraviolet radiation, an optical filter which receives the light from the condensing and reflecting mirror and transmits only ultraviolet rays having a specific wavelength, and the quartz rod on which the ultraviolet rays having the specific wavelength from the optical filter are struck.

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[3] The ultraviolet irradiation apparatus according to Claim 2, wherein the ultraviolet rays having the specific wavelength from the optical filter are struck on the quartz rod through a condensing optical system.

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[4] An ultraviolet irradiation apparatus for photochemical reactions, which is adapted to irradiate a photo-reactive solution, which undergoes a photochemical

4 reaction by irradiation of ultraviolet radiation, with the
5 ultraviolet radiation;
6 the apparatus comprising an electric discharge lamp which
7 emits light within a wavelength range from an ultraviolet
8 region to an infrared region, a condensing and reflecting
9 mirror for condensing and reflecting the light from the
10 electric discharge lamp, an plane mirror for reflecting
11 the light from the condensing and reflecting mirror, an
12 optical filter on which the light from the plane mirror is
13 struck through an incident lens and which transmits only
14 ultraviolet rays having a specific wavelength, at least
15 one condensing lens on which the ultraviolet rays having
16 the specific wavelength from the optical filter are struck,
17 and a quartz rod on which the ultraviolet rays from the
18 condensing lens are struck, wherein the photo-reactive
19 solution is irradiated with the ultraviolet rays from the
20 quartz rod.

1 [5] The ultraviolet irradiation apparatus for
2 photochemical reactions according to Claim 4, wherein the
3 electric discharge lamp is a super high pressure mercury
4 lamp or xenon-mercury lamp.

1 [6] The ultraviolet irradiation apparatus for
2 photochemical reactions according to Claim 4 or 5, wherein
3 at least one of the condensing and reflecting mirror and
4 the plane mirror has wavelength selective property that

5 ultraviolet rays within a wavelength range including the
6 specific wavelength are reflected.

1 [7] The ultraviolet irradiation apparatus for
2 photochemical reactions according to any one of Claims 1
3 to 6, wherein the quartz rod is immersed in the photo-
4 reactive solution within the reaction vessel.

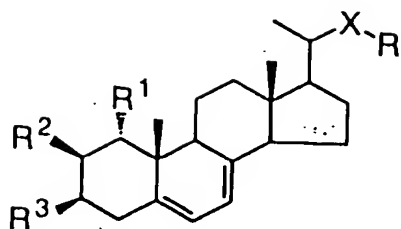
1 [8] The ultraviolet irradiation apparatus for
2 photochemical reactions according to any one of Claims 1
3 to 6, wherein the ultraviolet rays from the quartz rod are
4 struck on the reaction vessel made of a transparent
5 material, in which the photo-reactive solution is present.

1 [9] The ultraviolet irradiation apparatus for
2 photochemical reactions according to Claim 8, wherein the
3 ultraviolet rays from the quartz rod are struck on the
4 reaction vessel, in which the photo-reactive solution is
5 present, through a projecting lens.

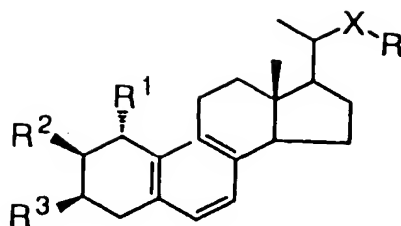
1 [10] The ultraviolet irradiation apparatus for
2 photochemical reactions according to any one of Claims 1
3 to 9, wherein the photo-reactive solution is a solution of
4 a provitamin D derivative from which a previtamin D
5 derivative is formed by a photochemical reaction, and the
6 ultraviolet rays having the specific wavelength are
7 ultraviolet rays having a wavelength of 280 to 320 nm.

1 [11] A process for preparing a vitamin D
2 derivative, comprising:
3 using an ultraviolet irradiation apparatus for
4 photochemical reactions, which comprises an ultraviolet
5 radiation-emitting lamp, an optical system on which light
6 from the ultraviolet radiation-emitting lamp is struck,
7 and which emits ultraviolet rays having a specific
8 wavelength, and a quartz rod on which the ultraviolet rays
9 having the specific wavelength from the optical system are
10 struck, irradiating a solution of a provitamin D
11 derivative with the ultraviolet rays having the specific
12 wavelength emitted from the quartz rod of the ultraviolet
13 irradiation apparatus to cause a photochemical reaction to
14 the provitamin D derivative solution, thereby forming a
15 previtamin D derivative;
16 and subjecting the previtamin D derivative to a thermal
17 isomerization reaction to prepare the vitamin D derivative.

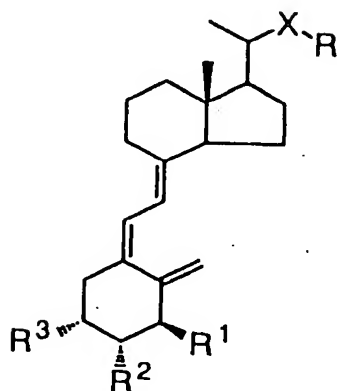
1 [12] The process according to Claim 11 for preparing
2 the vitamin D derivative, wherein the provitamin D
3 derivative is a compound represented by the following
4 general formula 1, the previtamin D derivative is a
5 compound represented by the following general formula 2,
6 and the vitamin D derivative is a compound represented by
7 the following general formula 3.



General Formula 1



General Formula 2



General Formula 3

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 9 wherein R^1 and R^3 individually mean a hydrogen atom or a
 10 hydroxyl group which may have a protecting group, R^2
 11 denotes a hydrogen atom, a hydroxyl group which may have a
 12 protecting group, a lower alkoxy group having 1 to 10
 13 carbon atoms which may be substituted or a lower alkyl
 14 group having 1 to 10 carbon atoms which may be substituted,
 15 R is a hydrogen atom or a lower alkyl group having 1 to 10
 16 carbon atoms which may be substituted, and X represents -
 17 $O-CH_2-$, $-S-CH_2-$, $-CH_2-CH_2-$, $-CH=CH-$ or $-N-(R^4)-CH_2-$, in
 18 which R^4 means a hydrogen atom or a lower alkyl group
 19 having 1 to 10 carbon atoms which may be substituted.

1 [13] A process for preparing a vitamin D derivative,
2 comprising irradiating a solution of a provitamin D
3 derivative represented by the general formula 1 according
4 to Claim 12 with ultraviolet rays having a specific
5 wavelength emitted from the ultraviolet irradiation
6 apparatus for photochemical reactions according to Claim
7 11 to cause a photochemical reaction of the provitamin D
8 derivative solution, thereby forming a previtamin D
9 derivative represented by the general formula 2 according
10 to Claim 12.

1 [14] The preparation process according to Claim 12,
2 wherein in the general formulae 1, 2 and 3, R^3 is a
3 hydroxyl group, and X is $-O-CH_2-$.

1 [15] The preparation process according to Claim 14,
2 wherein in the general formulae 1, 2 and 3, R^1 is a
3 hydroxyl group.

1 [16] The preparation process according to Claim 15,
2 wherein in the general formulae 1, 2 and 3, R^2 is a
3 hydrogen atom.

1 [17] The preparation process according to Claim 16,
2 wherein in the general formulae 1, 2 and 3, R is $-CH_2-$
3 $C(CH_3)_2OH$.

1 [18] The preparation process according to Claim 16,
2 wherein in the general formulae 1, 2 and 3, R is $-\text{CH}_2-$
3 $\text{CH}(\text{CH}_3)_2$.

1 [19] The preparation process according to Claim 13,
2 wherein in the general formulae 1 and 2, R^3 is a hydroxyl
3 group, and X is $-\text{O}-\text{CH}_2-$.

1 [20] The preparation process according to Claim 19,
2 wherein in the general formulae 1 and 2, R^1 is a hydroxyl
3 group.

1 [21] The preparation process according to Claim 20,
2 wherein in the general formulae 1 and 2, R^2 is a hydrogen
3 atom.

1 [22] The preparation process according to Claim 21,
2 wherein in the general formulae 1 and 2, R is $-\text{CH}_2-$
3 $\text{C}(\text{CH}_3)_2\text{OH}$.

1 [23] The preparation process according to Claim 21,
2 wherein in the general formulae 1 and 2, R is $-\text{CH}_2-\text{CH}(\text{CH}_3)_2$.

1 [24] The preparation process according to Claim 12,
2 wherein in the general formulae 1, 2 and 3, R^3 is a
3 hydroxyl group, and X is $-\text{CH}_2-\text{CH}_2-$.

1 [25] The preparation process according to Claim 24,
2 wherein in the general formulae 1, 2 and 3, R¹ is a
3 hydroxyl group.

1 [26] The preparation process according to Claim 25,
2 wherein in the general formulae 1, 2 and 3, R² is a
3 hydrogen atom.

1 [27] The preparation process according to Claim 25,
2 wherein in the general formulae 1, 2 and 3, R² is a
3 hydroxypropoxy group.

1 [28] The preparation process according to Claim 26,
2 wherein in the general formulae 1, 2 and 3, R is -CH₂-
3 C(CH₃)₂OH.

1 [29] The preparation process according to Claim 26,
2 wherein in the general formulae 1, 2 and 3, R is -CH₂-
3 CH(CH₃)₂.

1 [30] The preparation process according to Claim 27,
2 wherein in the general formulae 1, 2 and 3, R is -CH₂-
3 C(CH₃)₂OH.

1 [31] The preparation process according to Claim 27,
2 wherein in the general formulae 1, 2 and 3, R is -CH₂-
3 CH(CH₃)₂.

1 [32] The preparation process according to Claim 13,
2 wherein in the general formulae 1 and 2, R^3 is a hydroxyl
3 group, and X is $-\text{CH}_2-\text{CH}_2-$.

1 [33] The preparation process according to Claim 32,
2 wherein in the general formulae 1 and 2, R^1 is a hydroxyl
3 group.

1 [34] The preparation process according to Claim 33,
2 wherein in the general formulae 1 and 2, R^2 is a hydrogen
3 atom.

1 [35] The preparation process according to Claim 33,
2 wherein in the general formulae 1 and 2, R^2 is a
3 hydroxypropoxy group.

1 [36] The preparation process according to Claim 34,
2 wherein in the general formulae 1 and 2, R is $-\text{CH}_2-$
3 $\text{C}(\text{CH}_3)_2\text{OH}$.

1 [37] The preparation process according to Claim 34,
2 wherein in the general formulae 1 and 2, R is $-\text{CH}_2-\text{CH}(\text{CH}_3)_2$.

1 [38] The preparation process according to Claim 35,
2 wherein in the general formulae 1 and 2, R is $-\text{CH}_2-$
3 $\text{C}(\text{CH}_3)_2\text{OH}$.

1 [39] The preparation process according to Claim 35,
2 wherein in the general formulae 1 and 2, R is $-\text{CH}_2-\text{CH}(\text{CH}_3)_2$.

1 [40] The preparation process according to Claim 12,
2 wherein in the general formulae 1, 2 and 3, R^3 is a
3 hydroxyl group, and X is $-\text{CH}=\text{CH}-$.

1 [41] The preparation process according to Claim 40,
2 wherein in the general formulae 1, 2 and 3, R^1 is a
3 hydroxyl group.

1 [42] The preparation process according to Claim 41,
2 wherein in the general formulae 1, 2 and 3, R^2 is a
3 hydrogen atom.

1 [43] The preparation process according to Claim 42,
2 wherein in the general formulae 1, 2 and 3, R is $-\text{CH}_2-$
3 $\text{C}(\text{CH}_3)_2\text{OH}$.

1 [44] The preparation process according to Claim 42,
2 wherein in the general formulae 1, 2 and 3, R is $-\text{CH}_2-$
3 $\text{CH}(\text{CH}_3)_2$.

1 [45] The preparation process according to Claim 13,
2 wherein in the general formulae 1 and 2, R^3 is a hydroxyl
3 group, and X is $-\text{CH}=\text{CH}-$.

1 [46] The preparation process according to Claim 45,
2 wherein in the general formulae 1 and 2, R^1 is a hydroxyl
3 group.

1 [47] The preparation process according to Claim 46,
2 wherein in the general formulae 1 and 2, R^2 is a hydrogen
3 atom.

1 [48] The preparation process according to Claim 47,
2 wherein in the general formulae 1 and 2, R is $-\text{CH}_2-$
3 $\text{C}(\text{CH}_3)_2\text{OH}$.

1 [49] The preparation process according to Claim 47,
2 wherein in the general formulae 1 and 2, R is $-\text{CH}_2-\text{CH}(\text{CH}_3)_2$.